

Vernier Software Newsletter

Volume 3 Number 1

Fall 1986

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We are breaking with tradition by sending this newsletter to everyone on our mailing list instead of just to purchasers of our programs. Since we are not publishing a new catalog until January, this newsletter will inform you of new products and give you some ideas for using Vernier Software products. We hope you find some of the information useful.

Free Site License!

We have to chuckle a little at the current rage in the educational software business about "Site Licensing." Many software companies are selling site licenses that grant the school permission to make as many copies of the program as they need. For example, you can get a site license for LogoWriter for \$395 plus \$99 per year. We have been granting a free site license to each purchaser of any of our programs since 1981. A letter is enclosed with each program authorizing the purchaser to make as many copies as they wish for use within one high school or one college department.

The other major trend in the software industry is the removal of copy protection. Our feeling about copy protection is the same as the 7-Up Company's feeling about caffeine: "Never had it—never will!"

Compatibility Report: Apple IIGS and Laser 128

Dave Vernier recently attended the Fall Software Developers' Conference at Apple, where the new Apple IIGS was introduced. If you haven't seen the IIGS in action yet, we recommend you do so. Apple is promoting the IIGS heavily as the educational computer of the future. It will run most existing Apple II software and it has a second "operation mode" in which powerful new features are available. The following is a report on IIGS compatibility with Vernier Software programs and hardware:

- ◊ All of the programs run fine with one known exception: Mode C of FREQUENCY METER did not work (this is now fixed, see free upgrade offer below). Our laboratory interfacing programs (PRECISION TIMER II, FREQUENCY METER, TEMPERATURE PLOTTER and VOLTAGE PLOTTER) and the programs on the *Project Programs* disk of *How to Build a Better Mousetrap* should be run with the IIGS set on "NORMAL" speed.
- ◊ The following hardware works fine and no modification is needed:
 - 2 and 4-probe temperature systems
 - 9-pin Voltage Input Unit
 - Advanced Interfacing Board
 - PASCO scientific photogate systems
- ◊ Hardware that uses the PB2 input line, including the microphone/amplifier parts kit, the 16-pin VIU, the #3 photogate of a photogate parts kit, and several of the *Mousetrap* projects do not work properly. We are researching this and will be informing you of the appropriate circuit changes in the next newsletter.

We have had only a few brief opportunities to test our products on the Laser 128 Apple "clone." The Laser 128 has a 9-pin sub-D game-port connector on the back (like a IIe or IIC). Everything we tried worked fine except:

- ◊ Precision Timer II does not run properly because of a software problem; this can probably be fixed with a program change.
- ◊ TEMPERATURE PLOTTER will not work due to a hardware problem. There must be something unusual about the Laser 128's PDL input lines.

A Major Revision: GRAPHICAL ANALYSIS III

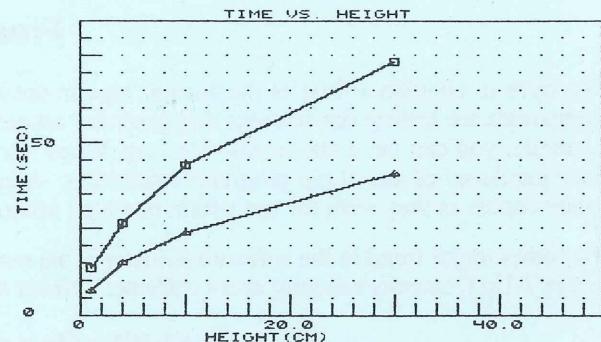
Our award winning program is now even better... and still only \$24.95!!

During the past three years we have talked to hundreds of teachers about GRAPHICAL ANALYSIS II. We have recently spent several months trying to add most of their suggestions to our own ideas to create GRAPHICAL ANALYSIS III. The major changes are summarized below:

- ◊ **Operating System:** The disk uses the ProDOS 8 operating system, which makes it easier to use 3.5 inch disk drives, hard disks and RAM disks.
- ◊ **AppleWorks Compatibility:** Data files can be transferred to and from AppleWorks by using the DIF file format.
- ◊ **Improved "User Interface":** The "look" of the program is now similar to AppleWorks. Menu selections can be made by using the arrow keys. A menu item is highlighted and pressing <RETURN> enters your selection. Values being entered can be edited with standard keystrokes. The <ESC> key can be used to return to the main menu.
- ◊ **New Data Manipulation Options:** Each axis can be manipulated separately. The following possibilities are allowed:
 - raise to any power sine
 - add any constant
 - subtract any constant
 - log (base 10)
 - log (base e)
 - sine
 - cosine
 - tangent
- ◊ **New Features Added to Graphs:** The graph style choice now allows you to activate any of the following features independently:
 - point protectors
 - grid
 - point-to-point line
 - linear regression line
 - bar graph
 - error bars (vertical and/or horizontal)
 - statistics of the linear regression line
- ◊ **Improved Scaling Options:** Each axis can be scaled separately. Manual Scaling has been improved so that if you select the value to be used at the origin, the program will suggest the appropriate value to be used for the scale.
- ◊ **Improved Graph Appearance:** A new font is used for the labels on the axes. Two labeled tic marks are included on the horizontal axis. The vertical axis is labeled with letters rotated counter-clockwise to make it easier to read. A title is included on every graph.
- ◊ **Handles Different "Series" of Data:** The data to be graphed can be divided into as many as four different series. A separate point-to-point line or regression line is drawn for each series. Different point-protector shapes are used for each series.
- ◊ **More Data Can be Graphed:** 512 data pairs are now permitted.
- ◊ **New File Handling Features:** The program allows you to set the ProDOS prefix, do a catalog or delete a file.
- ◊ **Data File Generation:** The program DATAMAKER is included on the disk. It can be used to generate data files using a mathematical function. These data files can then be loaded into GRAPHICAL ANALYSIS III and graphed.
- ◊ **Improved Rounding:** The rounding can be set for either a specific number of significant digits or for a specific number of digits to the right of the decimal point. Trailing zeros that should be displayed are displayed.
- ◊ **More Flexibility in Printing Graphs:** Built-in screen dumps for Grappler+ card, PKASO/U card or Imagewriter printer. The size of the graph is selectable and an optional form feed may be included.

Graphical Analysis III is now at our test sites. We will start shipping orders in mid-December. Graphical Analysis III will run on a 64K Apple II+, or any Apple IIe, IIc or IIGS.

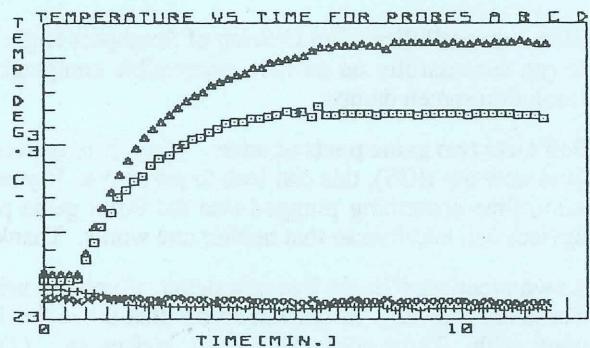
\$10.00 Upgrade Offer!! For purchasers of the old version of the program, GRAPHICAL ANALYSIS II, we offer the upgrade (new disk and manual) at a cost of \$10.00. (If you purchased Graphical Analysis II after November 1, 1986 you will automatically receive a free upgrade). Please return your original GRAPHICAL ANALYSIS II disk (with our logo label). You do not need to return the manual. A form for ordering this and other upgrades is included at the end of this newsletter.



Program Enhancements and Suggestions

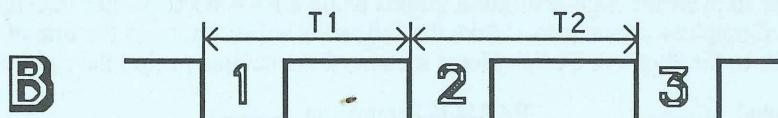
TEMPERATURE PLOTTER:

- ◊ There was a small error in TEMPERATURE PLOTTER programs shipped out before March of 1986. The key identifying the point protectors just before a graph using 3 or 4 probes is displayed had the "+" and the "X" reversed. To fix this error, you need to change two lines of the TEMPERATURE PLOTTER PART TWO program. Change the "X" in line 1640 to a "+" and the "+" in line 1641 to an "X". Of course, if you never use more than two probes you will never see the mistake. The key identifying the point protectors in the TEMPERATURE PLOTTER manual is correct.
- ◊ W. R. Janzen of Port Alberni, B.C. has commented that the chemicals we mentioned as examples to use in cooling curves, dichlorobenzene and naphthalene, are toxic. He suggests instead: long-chain alcohols (1-hexadecanol or 1-octadecanol) or fatty acids (hexadecanoic acid, octadecanoic acid, palmitic acid or stearic acid).
- ◊ Cyclohexane, which is sometimes used for freezing point depression experiments, has been reported to dissolve the silicone sealant that we have used to seal the ends of the temperature probes. (Recently, we have begun using a polyolefin meltable heat-shrink tubing to seal the ends of the probes. We hope it is more durable. It is certainly more attractive).
- ◊ TEMPERATURE PLOTTER and a 4-probe system were used for the "Energy House" competition at the Northwest Science Expo last spring. Each group of students was given a cardboard house with double walls (separated by about 2 cm), some cotton balls and some masking tape. Students were allowed to provide 10g of any other insulating material. The idea, of course, was to see who could best insulate the house. A bottle of hot water was placed in each house and the temperature inside the house was monitored for 12 minutes. The winning house was the one with the highest temperature at the end of the time period. TEMPERATURE PLOTTER helped make this an interesting spectator event because the students could watch the displays and see who was winning. A sample graph with two houses and two probes at room temperature is shown.
- ◊ One more reminder about our temperature probe systems: In the fall of 1985 we improved the design of the interface box used with the probes. We changed to polyester capacitors (for stability) and added a resistor to minimize "probe interaction." If you purchased your temperature probe system before then, you may want to upgrade your system. We sell a temperature probe upgrade kit for \$5.00, which includes 4 polyester capacitors and 4 metal-film (low temperature coefficient) resistors. You will need to solder them in yourself; directions are included.



PRECISION TIMER II:

- ◊ The LED and phototransistor recommended in the PRECISION TIMER II manual are manufactured by Texas Instruments. Unfortunately, Texas Instruments recently decided to get out of the optical electronics business. You may still be able to get TIL-414's and TIL-906's at Radio Shack stores for a while, but there are no more being made. After a great deal of searching, we have decided to use the following replacement parts: phototransistor #OP598 and LED #OP297. Both of these components are made by TRW. They seem to work just as well or better than the TI parts. One source of confusion might be the pin identification on the OP598 phototransistor. There is no flat spot, as there was on the Texas Instruments phototransistor. Instead there is a "bump" marking the emitter (which is used as the negative lead in the photogate).
- ◊ There was a mistake on the Timing Mode chart included in the early versions of PRECISION TIMER II. This mistake is only on the versions of the programs sold directly by Vernier Software (those sold by PASCO scientific have a different mode B and were correct). The timing chart for mode B should look like this:



- ◊ One convenient way to mount LEDs and phototransistors in a photogate is to use Radio Shack LED holders (RS# 276-080).
- ◊ Tom Ford, a PTRA from Maine, has developed an interesting system of measuring the period of the PSSC-style hand stroboscopes. Contact us if you are interested and we will send you a copy of Tom's information sheet.
- ◊ For those of you who still have the old Precision Timer (with no II at the end), we remind you that there is a \$10.00 upgrade to PRECISION TIMER II that includes new modes, graphing and many other improvements and a new manual.

◊ We have made a number of special modifications of PRECISION TIMER II lately. If you have purchased PRECISION TIMER II and are interested in any of these slightly modified versions of the program please contact us:

- Special mode and hardware addition to time two pinewood derby race cars in separate lanes.
- Change to mode C so that it measures 20 periods of a pendulum for very accurate determination of g.
- Software change so that all modes using only one photogate can use the PB2 input.
- Hardware suggestion for building a single Schmitt trigger photogate using one 555 timer. Both of the last two changes were suggested by people trying to keep expenses down, recognizing that you can do quite a few experiments with a single photogate.
- Software change so mode M can be controlled by keypresses. The teacher wanted to have the students press the key each time a rolling object passed evenly spaced marks to generate a distance versus time graph.

FREQUENCY METER (Free Upgrade Offer):

◊ We have improved several things on the FREQUENCY METER program:

- We were using the word "chromatic" where we should have used the word "diatonic" in both the program and the manual. Thanks to Robert Walker of Simon Frazier University and Wayne Janzen of Port Alberni, B.C. for bringing this to our attention.
- The frequencies generated by the program in the "SOUND UTILITIES" were 1/2 the value requested. Thanks to Edward Kluk of Dickensen State College for noticing this.
- As mentioned above, mode C of FREQUENCY METER was not compatible with the new Apple IIGS.

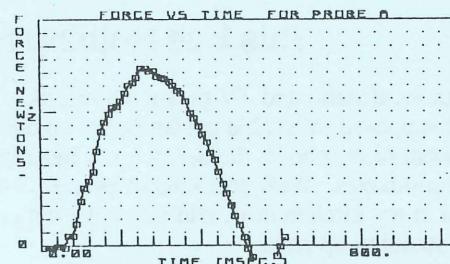
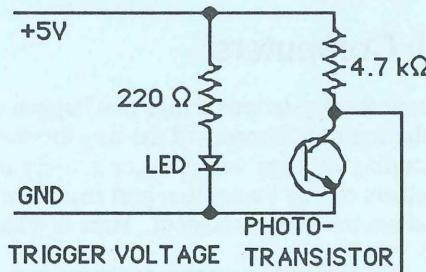
All three of these problems have been fixed, and a free upgrade is available by returning the original FREQUENCY METER disk (with our logo label). A form is included at the end of this newsletter.

◊ Paul Zitzewitz of The University of Michigan has developed an interesting lab using FREQUENCY METER to measure the speed of sound in air. Contact us and we will send you a copy of Paul's information sheet.

◊ Gerald P. Hart of Moorhead State University, MN had an article in *The Physics Teacher*, Feb. 1986 explaining how to use FREQUENCY METER to measure the speed of sound in a metal rod. It would make a good demonstration or lab.

VOLTAGE PLOTTER:

◊ We have developed a special version of VOLTAGE PLOTTER that can be used only with the Advanced Interfacing Board to allow "triggering." Any of the input lines can be designated as the trigger input. Data collection will not begin until the voltage on this line exceeds a specified level. This program can be used for a number of interesting experiments. One is to study impulse in the collision of an air track glider. If a glider collides with a bar equipped with strain gages (see Appendix C of the VOLTAGE PLOTTER manual), the force can be measured throughout the collision. The problem with doing this experiment without triggering is that you have a difficult time starting the data acquisition (pressing the <SPACE BAR>) at just the right time. A photogate is set up so that the glider blocks it just before the collision. A photogate circuit like the one diagrammed below can produce a voltage increase when blocked and trigger the data acquisition. A sample graph of an experiment run by Lowell Herr of The Catlin Gabel School, Portland, OR is also shown below:



The special version of VOLTAGE PLOTTER also includes an integration option designed to allow quick comparison of the area under the F vs. t graph and the change in momentum of the car. Lowell's results came out very good.

If you have purchased the VOLTAGE PLOTTER program and Advanced Interfacing Board, contact us for a free copy of this version of the program.

◊ In the January issue of *The American Journal of Physics*, Paul A Bender mentioned a Hall effect transducer for measuring magnetic field intensities. We have purchased several of these devices and have built an amplifier circuit so that their output can be monitored by VOLTAGE PLOTTER. Either a VIU or the Advanced Interfacing Board can be used as the input device. The system can be used to measure the magnetic induction near a magnet, or even to measure the magnetic field of the earth! If you would like the plans for the circuit we will be glad to send them to you.

◊ Jerry Aldrich of Alden, Iowa has written detailed instructions (including diagrams) on how to build a voltage expansion device for use with a VIU. The device is essentially a voltage divider circuit with one of the resistors selected by a rotary switch. Six voltage ranges are available with a maximum of 40 VDC. Contact us if you would like a copy of Jerry's instructions.

◊ There was a fairly obscure bug in VOLTAGE PLOTTER disks shipped before August 1986. The problem only occurs if you are using two VIUs at the same time. The bug is that the program would sometimes mistake one VIU for the other. If you use two VIUs at once, let us know and we will send you a new disk. Thanks to Bob McDonnell of Citrus College, CA for pointing this problem out to us.

How to Convert Vernier Software Data Files to AppleWorks

Several people have asked us about transferring data collected with our programs to Appleworks. If data is converted to AppleWorks format, it can be analyzed with a Data Base or Spreadsheet or included in a Word Processing document.

Five of our programs (GRAPHICAL ANALYSIS II, FREQUENCY METER, PRECISION TIMER II, TEMPERATURE PLOTTER and VOLTAGE PLOTTER) create data files. These files are all similar in structure. The procedure for converting data files created with our programs to AppleWorks is as follows:

1. **Convert the data files to ProDOS format.** Use the Apple CONVERT program that is included on the ProDOS User's Disk to create a new disk with the files stored in the ProDOS format. Refer to the Apple manuals for details. Note that ProDOS file names cannot include spaces or punctuation marks and cannot be longer than 15 characters. You may have to change the names of some of your data files. Make note of the exact name of the ProDOS file. You will need to know it later.

2. **Load the data files into AppleWorks as ASCII text files.** The files can be loaded for use either as a Data Base or for Word Processing. The procedure is a little involved, but should not be too difficult if you are familiar with AppleWorks and ProDOS. The procedure is outlined below; refer to the AppleWorks manual for details.

- Start up the AppleWorks program.
- Select "Add files to the Desktop" from the Main menu.
- Place the ProDOS data disk in a disk drive.
- Select "A different disk" from the Add Files menu to select the disk drive for the ProDOS disk containing the data file.
- Select either "Data Base" or "Word Processing" from the Add Files menu.
- Select "From a text (ASCII) file".
- If you are loading the data as a Data Base, enter 2 when you are asked, "How many categories per record?"
- Enter the exact name of the ProDOS data file as the "Pathname".
- Make up and enter a new name for the converted file when prompted, "Type a name for this new file".

You will probably want to rearrange and edit some of the data. The data is not yet saved on a disk in the AppleWorks compatible format. You may do so using normal AppleWorks procedures. If you want to use the data in a spreadsheet, transfer the data using the DIF file format as explained in the AppleWorks manuals.

Eventually, we hope to revise all of our laboratory interfacing programs so that they are compatible with AppleWorks and the new Graphical Analysis III.

This Has Nothing to Do with Computers

On September 23, our local radio and TV personalities talked endlessly about the mysterious things that happen on equinoxes. In particular, you are supposed to be able to stand eggs up on their end on the equinox "because of the way the sun and the earth are aligned." At a local high school, the science teacher reported that standing up eggs was a major activity and discussion topic on the last two equinoxes. Well, this kind of pseudoscience really bothers me, so I want to report that there are four eggs standing on their end in my kitchen now, and it is not even close to an equinox (or even a solstice). Here is what my research has taught me about standing up eggs:

1. If you are patient, you can probably stand up most eggs on any day of the year. The fact is, it is not easy, and nobody tries hard enough to do it except on equinoxes when someone convinces them that they can do it.
2. The best procedure is as follows: Shake the egg violently until you hear liquid moving inside it (you don't really break the yoke, but apparently things loosen up so that the yoke can move). Place the egg in a holder or lean it against something so that it is supported in a exact vertical position with the large end down. Leave the egg alone for 5 minutes to allow the yoke to settle to the bottom. The density of yoke is higher than the density of the egg white, so the center of mass is lower when the yoke settles down. Now carefully try to balance the egg. Never let it fall over very far or you will have to let the yoke settle again. The balancing is still not easy, but it usually can be done.
3. Warm eggs work better than cold eggs. The yoke moves more.
4. Old eggs work best. Leave one out of the refrigerator for a week and it will stand up easier. A friend of mine reported that he stood up a dozen when he was a kid in England right after WWII. In those days few people had refrigerators and eggs were not as fresh as we are used to. Apparently the egg white becomes less viscous (as well as smellier) as it ages.



Our New Book on Laboratory Interfacing

Our new book, *How to Build A Better Mousetrap and 13 Other Projects Using the Apple II®* is aimed at students (or teachers) who want to learn about laboratory interfacing. It is a great book for independent study or science fair projects. The following projects are included in the book:

• Photogate Timer	• IC Temperature Probe	• Optically-Isolated Switches
• Reaction Time	• Voltage Monitor	• Computer-Controlled Car
• Microphone/Amplifier	• Thermocouple	• Stepper Motor
• Humidity Meter	• pH Meter	• A Better Mousetrap
• Resistance/Capacitance Meter	• Strain Gage	

All projects require an Apple II+ or IIe with a disk drive. \$24.95 includes 227 page book with 177 diagrams and sample programs disk. We are also selling parts kits for nine of the projects. If you would like more information on the book, check the appropriate box on the newsletter response form.

Miscellaneous Information

- ◊ **IBM compatibility:** Jim O'Brien of Southport High School, Indianapolis reports that he has been able to get our programs to run successfully on an IBM compatible computer using a QuadLink Expansion Board. He was even able to do high-resolution screen dumps.
- ◊ **Don't use two game ports at once:** While it is convenient that Apple includes two game port connectors on the Apple IIe (and now the IIGS), this can lead to problems. If you have something plugged into the internal 16-pin game port and at the same time something plugged into the 9-pin game port on the back, you may have problems. The signals from the two devices can interfere so that neither one works. Thanks to H. Bixler Baker of Berlin, West Germany for pointing this out.
- ◊ As we mentioned in our last newsletter, if you are using the 16-pin game port, consider purchasing a "game port extender." These are basically "extension cords" that move the 16-pin game socket to the outside of the computer where it is easier to work with. Three sources of these devices are: (1) SCRG, P. O. Box 593, Moorpark, CA 93020, (800) 635-8310, (2) Happ Electronics, Inc., 4640 Island View, Oshkosh, WI 54901, (414) 231-5128, and (3) Consider It Dunn, Box 5362, Oregon City, OR 97045.

One way to completely avoid using the 16-pin game socket if you are using an Apple IIe is to use the 9-pin socket on the back of the Apple IIe. All of the input leads are provided at the 9-pin connector. The leads are electrically the same as the leads on the 16-pin socket. The only thing you cannot do with the 9-pin socket is use the annunciator output lines to turn on and off devices (as we suggest in *How to Build a Better Mousetrap*). When you order photogate parts kits, temperature probes or VIU hardware from us, we will provide 9-pin plugs if you request them on your purchase order.

- ◊ **Screen dump improvements:** One of the questions we get asked most often is, "How can I get the graphs to print larger?" A one-line BASIC program change allows you to double the size of the graph from any of our interfacing programs. A different line is changed depending on whether you are using an ImageWriter printer or a Grappler+ interface card. Refer to the Program Design Notes section of the manual to determine which line numbers are the "screen dump" section of the program. If you are using an ImageWriter, change the "1" to a "3" in the line that originally reads POKE 36864,PR,1. If you are using a Grappler+ card, change the "G2E" to "G2EDR" in the statement that sends the graphics to the Grappler+. Some people have added a line to the programs that allows the user to select the size of the graph.

Another change that some of you may want to add is a "FORM FEED" command after the graph so that the paper advances to where it can be taken out of the printer. To do this, add a PRINT CHR\$(12) command after the graph is printed and before the printer is turned off with PR#0. Thanks to Nancy Albert of Citrus College, CA for this suggestion.

Many people have asked how to print the high-resolution graphs using a PKASO/U printer interface card. The PKASO/U commands are similar to the Grappler+ commands. Make the following substitutions in the line of the program that is used to control the Grappler+ (refer to the Program Design Notes section of the manual to find the right section of the program).

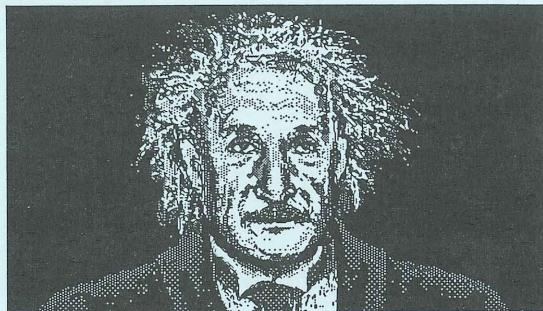
Grappler+ command
PRINT CHR\$(9);"G2E"
PRINT CHR\$(9);"G2EDR"

PKASO/U command
PRINT CHR\$(9);"1H"
PRINT CHR\$(9);"7H"

All of the screen dump improvements mentioned above are included in the new GRAPHICAL ANALYSIS III program.

Upcoming Conferences

We will be conducting a commercial workshop and will have a booth at the January AAPT meeting in San Francisco. The workshop will be a three hour session in which participants will build a Voltage Input Unit and learn to use our VOLTAGE PLOTTER program. Participants will take home both the software and the hardware. The workshop cost is \$40.00. Sign up through AAPT if you are interested. We will also have booths at the NCCE conference in Portland, Oregon on February 5-7 and the National Science Teachers Association meeting in Washington, D.C. in March. If you attend any of these conferences, stop by and say "hello."



Albert Einstein drawing from "Click Art",
Macintosh artwork by T.Maker Software

Science Humor

- ◊ When discussing static electricity and lightning, I always mention to the students that my brother who worked for the railroad was once hit by lightning. This always gets their interest and they ask if he was killed. I tell them, "No, he wasn't even hurt; he never was a very good conductor!"
- ◊ Alan Griffith of Columbus, NE reports that he began a unit on electrical power by asking the students for a verbal definition of the term "power." Without a moment of hesitation, one student answered "the ability to assign grades."
- ◊ Science teacher to rowdy class: "I will not begin today's lecture until the room settles down." Voice from the back of the class: "Go home and sleep it off."
- ◊ Lora Wilhite sent us an article about a suggestion made by a Tennessee man to "metrify" some insect names. He pointed out that a centipede does not have 10^{-2} legs and a millipede does not have 10^{-3} legs. He proposed renaming them hectopede and kilopede. The article goes on to complicate things further by reporting that any arthropod of the class Chilopoda can be called a centipede and they can have from 28 to 354 legs. Any arthropod of the class Diplopoda can be called a millipede and they have from 44 to 400 legs. Life is complicated.
- ◊ Clarence Bakken from Palo Alto H.S. reports that the following joke won a pizza in a joke contest at Stanford University:

Science teacher: "Like charges repel, unlike charges attract."

Student: "What happens if you have no charge?"

Science teacher: "You pay cash."

Strange Priorities

The new Stealth bombers are estimated to cost between \$277 and \$600 million each.¹ Using the low estimate, that is \$22,600 for each of the 12,223 high schools in the United States.² That is probably enough to pay the starting salary of one science teacher per high school for a year. Another way to look at it is that is enough to buy 18 new Apple IIe's with a monitor and disk drive for every high school in the U.S.³ And that's for one airplane....

Notes from the Marketing Department

Did anyone notice that PRECISION TIMER was pictured in the November 10, 1986 issue of *U.S. News & World Report*, (p. 79)? You had to look closely, but those large timing digits were ours! Vernier Software products are being used in a number of interfacing workshops all over the country. David just returned from Fresno, CA where 34 teachers each built a Voltage Input Unit and one project from our *Mousetrap* book.

Answers to questions we are often asked: "Is your name really Vernier?" Yes. "Is it true that Vernier Software is run by just the two of you?" Just us and a few of David's former students, who assemble hardware for us. "Will you be writing another book?" David says maybe and I say NO WAY! Keep your cards and letters coming....Chris

¹The low estimate is from the defense department (*Aviation Week & Space Technology*, June 9, 1986, p. 25); the higher estimate is by Congressman Mike Synar (*Time*, March 24, 1986, p. 30).

²The *Sales Manager's Guide to the U.S. School Market, School Year 1985/1986* published by Market Data Retrieval, Inc. reports that there are 10,399 grade 9-12 and 1,824 grade 10-12 high schools in the U.S. (including Catholic and private schools).

³Official Apple list prices as of Oct. 15, 1986: CPU = \$829, 5.25" drive = \$299, B&W monitor = \$129, total = \$1257.

Vernier Software Newsletter Response Form - Fall 1986

Please send me the following upgrades:

<input type="checkbox"/> GRAPHICAL ANALYSIS III	\$10.00	(Return your original GRAPHICAL ANALYSIS II disk)
<input type="checkbox"/> FREQUENCY METER	\$FREE	(Return your original FREQUENCY METER disk)
<input type="checkbox"/> PRECISION TIMER II (Fall 1985 upgrade)	\$10.00	(Return your original PRECISION TIMER disk)
<input type="checkbox"/> TEMPERATURE PLOTTER HARDWARE UPGRADE KIT (Fall 1985 upgrade)	\$5.00	

Please send me information on the following items mentioned in the newsletter: _____

I can't wait until January. Please send me a catalog now.

Please send me a flyer on *How to Build a Better Mousetrap and 13 Other Science Projects for the Apple II®*.

P.O. # _____

Your Name _____

School _____

Address _____

City/State/Zip _____

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Portland, Oregon 97225
(503) 297-5317
MCI Mail: Vernier, 308-3077
CompuServe: 72366,601



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